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Citation: Greife, Matthew, Stretesky, Paul, O'Conner Shelley, Tara and Pogrebin, Mark (2015) Corporate Environmental Crime and Environmental Justice. Criminal Justice Policy Review. ISSN 0887-4034

Published by: SAGE

URL: <http://dx.doi.org/10.1177/0887403415576742>  
<<http://dx.doi.org/10.1177/0887403415576742>>

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**Deposited in NRL:**

4 – March – 2015

**Item type:**

Peer reviewed article

**Date of acceptance:**

16 –February – 2015

**Date of publication:**

In press

**Citation to published item:**

Greife, Matthew J., Paul B. Stretesky, Tara O’Conner Shelley and Mark R. Pogrebin. (Forthcoming). Corporate Environmental Crime and Environmental Justice. *Criminal Justice Policy Review*.

**DOI:**

**URL to published item:**

<http://cjp.sagepub.com/content/by/year>

**Additional information:**

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# **CORPORATE ENVIRONMENTAL CRIME AND ENVIRONMENTAL JUSTICE**

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Paper Accepted by Criminal Justice Policy Review on February 16, 2015  
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## **Corporate Environmental Crime and Environmental Justice**

**Abstract:** Executive Order 12898 (42 U.S.C. § 4321 [2000]) mandates that federal agencies in the United States make it their purpose to achieve environmental justice. As a result, agencies often rely on empirical studies to provide crucial information that can be used to implement policies to combat inequality. While numerous studies now examine the distribution of environmental burdens and benefits, there are no systematic empirical studies that examine inequality in criminal penalties. This study corrects that omission by presenting findings on the relationship between community demographics and monetary penalties (fines) against corporations for 121 criminal violations of federal environmental law that were adjudicated between the years 2005 and 2010. Our results suggest that fines are not correlated with the demographics of residents living near the crime. That is, corporations that committed their environmental crimes in minority and poor areas did not receive lower fines as a result. Thus, environmental justice concerns appear to be satisfied with respect to federal criminal prosecutions.

Keywords: Corporate Punishment; Environmental Equity; Environmental Crime; Green Criminology

## **Introduction**

In 1990 Michael Lynch suggested that a “green criminology” should be at the center of the discipline’s development. Within this new green criminology, environmental justice is a central concept (Stretesky, 2008). White (2008, 50), for instance, elaborates that green criminology must emphasize “environmental justice with a special focus on human rights, social equity and ecological justice.” Whether one is using an environmental justice perspective or some other perspective such as ecological justice to inform their research, most green criminologists now study a range of environmental harms, some of which are legal and some of which are illegal (White & Heckenberg, 2014; White, 2013). This study extends the green criminology tradition by focusing on environmental justice concerns identified in Executive Order 12898 (42 U.S.C. § 4321 [2000]), which mandates that federal policies should encourage the “fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.”<sup>i</sup> Specifically, we examine whether the composition of race/ethnicity and/or the poverty of communities surrounding environmental violations is inversely correlated with the monetary penalties assessed by the federal government for those violations. If penalties are, on average, lower in communities that are minority and/or poor, then national policies may need to be adopted to tackle that problem.

The current study is focused specifically on illegal behavior; however, green criminologists adopt a framework for studying environmental harm that is inclusive and often examine both criminal and non-criminal behavior. This approach is advantageous, and studying the adverse effects of legal and illegal actions is nothing new in the discipline. That is, criminologists and legal researchers often study activities that are considered legal and legitimate

but which nonetheless have detrimental impacts on people and environments (Hillyard & Tombs, 2007; Sutherland, 1949; White, 2003). The emphasis green criminologists place on studying both legal and illegal activities is most easily recognized as advantageous within the real-world applications of environmental law. For instance, in *US v. White* (1991) the testimony from the EPA's assistant administrator emphasizes that the definition of environmental hazards is constantly changing as the agency modifies its administrative rules. Therefore, a flexible conceptual framework like green criminology is necessary to study the full array of environmental harms that may shift between criminal and non-criminal behavior over time and place.

Further, a green criminology framework is advantageous because it allows researchers to use traditional criminological theories and/or draw upon theories from other fields, such as environmental sociology, when analyzing crimes against the environment (Stretesky et al., 2014).<sup>ii</sup> While environmental justice is not nested within a traditional criminological theory, it is highly relevant for this study since prosecutors are explicitly mandated by Executive Order 12898 (42 U.S.C. § 4321 [2000]) to take environmental justice considerations into account when prosecuting individuals and corporations for violation of environmental criminal laws (Dighe & Pettus, 2011; Stretesky et al., 2014; White, 2013). As such, we examine hypotheses derived from an environmental justice perspective to analyze the outcomes of 121 plea bargains,<sup>iii</sup> obtained via a Freedom of Information Act (FOIA) request from the U.S. Department of Justice, between the years 2005 and 2010 against corporations that were prosecuted for environmental crime.<sup>iv</sup>

### **Environmental Justice**

The environmental justice (sometimes referred to as environmental equity—see generally Atlas, 2001; Schlosberg, 2007; Rhodes, 2005) movement is a grassroots effort developing out of

the civil rights and environmental movements (Cole & Foster, 2001; Taylor, 2000). The movement advocates greater levels of environmental protection and an end to policies perpetuating environmental inequality. The movement became prominent in 1983 when Reverend Benjamin Chavis—a prominent civil rights activist—held a six-week protest (which resulted in over 550 arrests) to rally against the siting of a toxic waste landfill in Warren County, North Carolina. The Warren County landfill was constructed to store PCBs that were illegally dumped along hundreds of miles of North Carolina road (Bullard, 1994).<sup>v</sup> As Bullard (1994) notes, Warren County residents were poor and African American and he therefore argues that the PCBs were being stored in their community because the government viewed it as expendable.

The Warren County protests brought issues of environmental justice to the forefront of the environmental and civil rights movements and served as a springboard for subsequent research that revealed that poor and minority communities were overburdened by environmental harms (Bullard, 1990; U.S. General Accounting Office, 1983; United Church of Christ, 1987). This research, and the work of grassroots advocates, eventually influenced the federal government to concern itself with environmental justice. As noted, Executive Order 12898, which President Bill Clinton issued on February 11, 1994, instructed each and every federal agency to make environmental justice a part of its mission of service (42 U.S.C. § 4321 [2000]).

Shortly after executive order 12898 (42 U.S.C. § 4321 [2000]) was signed, the U.S. Department of Justice created an environmental justice strategy laying out the way administrative, civil, and criminal legal actions would be carried out (U.S. Department of Justice, 1995). While the DOJ and other federal agencies recognize environmental justice concerns and state that they are actively working toward alleviating the burden of disproportionate impact from environmental harms faced by disadvantaged communities, there is still much work to be



done. Indeed, in 2010, the EPA and the White House Council on Environmental Quality met for the first time in over a decade and stated that there was still a need for better strategies that incorporate environmental justice concerns into criminal prosecutions for violations of environmental laws (Dighe & Pettus, 2011).

While the federal government admits the need for better strategies, no one, to our knowledge, has actually determined whether environmental injustices are occurring in outcomes of criminal prosecution for violation of environmental criminal laws. Some may argue that there is reason to believe environmental injustice is not occurring because federal agencies have been cognizant of environmental justice concerns. For example, each year the EPA releases progress reports and details various civil and criminal legal actions taken against individuals and corporations where environmental justice concerns were a determinant in the punishment levied.<sup>vi</sup> However, the cases listed in these progress reports are anecdotal and limited to only a handful of the many civil and criminal actions taken each year. These cases are likely to show success stories rather than draw attention to agency problems.<sup>vii</sup> Therefore, independent research is needed to learn whether environmental justice concerns are being taken into consideration on a larger scale—not just with a select few cases highlighted on a website.

### Prior Studies

There are two main areas of inquiry that follow the EPA's definition of environmental justice. The first tract of inquiry focuses on determining whether or not poor and minority communities are unduly burdened by environmental hazards because of the communities' proximity to hazardous waste disposal sites and other polluting facilities. If researchers find that these facilities are located disproportionately in poor and/or minority communities, then there is reason to believe environmental injustice is occurring. A majority of studies in this first tract of

inquiry provide evidence that poor and minority communities are more likely to be located near hazardous waste disposal sites and/or near a high concentration of polluting facilities (Brown, 1995; Bryant, 1995; Bullard, 1994; Downey, 1998; Mohai & Bunyon, 1992; Pastor, Sadd, & Hipp, 2001; Ringquist, 2005; Stretesky & Hogan, 1998). There are some methodological challenges to these conclusions (e.g., Anderton et al., 1994), but a detailed discussion of these debates is not necessary for the present analysis.<sup>viii</sup>

The second tract of inquiry looks at environmental justice issues within the legal system. Specifically, this research focuses on determining whether corporations located in poor and minority communities are (1) more likely to be subject to regulatory inspections (Konisky, 2009); and (2) punished more severely for violating environmental laws in these communities (Atlas, 2001; Lavelle & Coyle, 1992; Lynch, Stretesky, & Burns, 2004; Mennis, 2005; and Ringquist, 1998). If corporations in poor and/or minority communities are inspected less frequently and punished less severely for violations, then there is reason to believe environmental injustice is occurring within the legal system by perpetuating environmental inequality within these communities. It is this second tract of inquiry which is most relevant to our study.

Regarding inspections, Konisky (2009) discovered that regulatory agencies carry out fewer inspections in poorer counties. Further, Konisky (2009) found that while facilities in poor counties are inspected less frequently, there is no evidence suggesting race-based disparities are occurring in the case of inspections. Thus, in Konisky's (2009) study, the environmental injustice regarding inspections is experienced by class, not race.

With respect to studies analyzing legal outcomes assessed against corporations for violating environmental laws, there are only a small number of studies that draw upon an

environmental justice framework. These studies investigate cases handled in state court or federal court and focus on civil and administrative law outcomes—not criminal law. At the state level, Mennis (2005) found that air-polluting facilities in New Jersey located in areas with high percentages of minorities received fines which were lower than those received by facilities located in predominantly white areas. Also, Lynch, Stretesky, & Burns (2004) examined penalties assessed against oil refineries in Texas between the years 2001 and 2003 for environmental law violations, and found that the penalties assessed against refineries tended to be lower in zip code tracts made up primarily of Hispanic and low-income residents.

At the federal level, there are only three studies examining legal outcomes for civil law violations. In 1992, the *National Law Journal* (hereinafter NLJ) published a study examining the fines assessed against corporations for civil environmental violations and how those fines varied in size based upon how many minorities lived near a hazard site (Lavelle & Coyle, 1992). The NLJ findings claimed that the EPA and the courts engaged in a pattern of discriminatory practices—more specifically, as the number of minorities increased around a hazard site, the size of the fine assessed against a corporation would decrease. In particular, the NLJ articles claimed that penalties in communities predominantly occupied by whites were found to be 46% higher than penalties in zip codes with minority residents (\$153,067 vs. \$105,028), and penalties in zip codes with high-income residents were 53% higher than penalties in zip codes with low-income residents (\$146,993 vs. \$95,664).<sup>ix</sup>

The NLJ study stimulated significant controversy and additional research. The two major studies that followed the NLJ article were Evan Ringquist's (1998) article "A Question of Justice: Equity in Environmental Litigation, 1974-1991" and Mark Atlas's (2001) follow-up to Ringquist's article, titled "Rush to Judgment: An Empirical Analysis of Environmental Equity in

U.S. Environmental Protection Agency Enforcement Actions.” Ringquist’s study adhered to the methods used in the NLJ study as much as possible in an effort to replicate NLJ’s findings; however, he improved on the NLJ study by controlling for judicial and corporation status,<sup>x</sup> among other factors (Ringquist, 1998). Ringquist concluded that there was no negative statistically significant relationship between the percentage of minority residents, income, and the civil fines assessed against corporations for environmental hazards (Ringquist, 1998, 1162).

Following Ringquist (1998), Atlas (2001) set out to create the definitive study regarding legal outcomes and environmental justice. Atlas (2001) improved upon Ringquist’s research by using one-mile concentric rings around a hazard site rather than the larger zip codes where the civil violation occurred, to better measure the population affected by the hazard. Further, Atlas (2001) attempted to control for the particular circumstances surrounding each case—arguing that the potential danger posed by the environmental hazard would be the major determinant for receiving a high fine. Atlas (2001) ultimately concluded that there was no negative statistically significant relationship between race, income, and monetary penalties assessed against corporations for environmental hazards.<sup>xi</sup> Finally, Atlas (2001) found that the facts of a case best predict the outcome of legal actions against corporations for violating environmental law—a finding seen in other studies on criminal justice outcomes (see generally Steffensmeier & Demuth, 2000). At the federal level, both Ringquist (1998) and Atlas (2001) found that environmental injustice was not occurring in civil litigation outcomes involving corporate violations of environmental laws. Atlas (2001) rightly argues that looking only at civil case outcomes does not represent a holistic view of litigation outcomes—researchers also need to look at administrative and criminal case outcomes.

This study was designed to answer part of Atlas’s call, as we examine criminal case outcomes at the federal level—a context that has not been previously investigated in environmental justice research. Criminal cases have serious implications for issues of environmental justice. First, criminal prosecutions are supposed to be reserved for only the most severe offenses (Black, 1976; O’Hear, 2004). This means that if a corporation violates an environmental law, it can be both civilly and criminally liable; however, the criminal prosecution should only occur if the violation is so severe that a civil penalty would not be enough to compensate victims, pay for cleanup, and serve as an adequate deterrent against future crimes. For instance, 33 U.S.C. §1321(b)(7)(D) is a civil statute allowing federal authorities to claim up to \$100,000 per day if an oil spill results from the “gross negligence” of a corporation. On the other hand, the criminal statute 33 U.S.C. § 1319(c)(1)(A) allows federal authorities to claim up to \$250,000 per day if a corporation’s oil spill results from criminal negligence.

Second, in criminal prosecutions the defendant must be proven to have a specific mindset when they committed the crime, and that mental state along with all other evidence must be proven beyond a reasonable doubt. For instance, 33 U.S.C. § 1319(c)(2)(A) requires that the defendant “knowingly” committed the crime. Knowing intent is generally defined as engaging in conduct where a defendant is practically certain an outcome will occur. Civil cases, on the other hand, rarely have to prove a mental state, and responsibility must be proven only by a preponderance of the evidence (i.e., something is true more likely than not). Therefore the overall evidentiary burden is much greater in criminal court than in civil court, because of the severity associated with criminal sanctions.

Third, there is reason to believe that the social ramifications of a criminal conviction and the subsequent labeling of a corporation as “criminal” have a much greater negative societal effect than simply being found liable for violating a civil statute (Weissmann, 2007).

With the abovementioned literature and legal context in mind, we have formed two hypotheses to inform the present study.

[H1]: Penalties levied against corporate actors that committed an environmental crime will be less severe as the proportion of minorities living near that environmental crime increases.

[H2]: Penalties levied against corporate actors that committed an environmental crime will be less severe as the proportion of poor living near the environmental crime increases.

### **Data and Methods**

To examine the relationship between race, ethnicity, poverty, and penalty outcomes we first collected data about the criminal prosecutions of corporations that occurred in the United States between 2005 and 2010 (n=245).<sup>xii</sup> Basic case information about environmental prosecutions (case numbers and venues) was obtained via a Freedom of Information Act request from the Environmental Protection Agency for all cases that were forwarded and accepted for criminal prosecution by the Department of Justice. In the United States, the Department of Justice acts as the prosecutor for federal agencies in criminal cases—though DOJ attorneys often collaborate with attorneys from the agencies forwarding cases to them for prosecution. The information from the EPA allowed us to match Department of Justice case numbers to online electronic case files submitted to a legal database called PACER.<sup>xiii,xiv</sup> The following information was collected from PACER: (1) the original criminal complaint or indictment; (2) plea

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**Deposited in NRL:**

4 – March – 2015

**Item type:**

Peer reviewed article

**Date of acceptance:**

16 –February – 2015

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In press

**Citation to published item:**

Greife, Matthew J., Paul B. Stretesky, Tara O’Conner Shelley and Mark R. Pogrebin. (Forthcoming). Corporate Environmental Crime and Environmental Justice. *Criminal Justice Policy Review*.

**DOI:**

**URL to published item:**

<http://cjp.sagepub.com/content/by/year>

**Additional information:**

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agreements; (3) the factual basis for the plea agreement; and (4) official sentencing documents.<sup>xv</sup>

Two additional points need to be made about PACER cases. First, these cases follow the typical pattern of adjudication of all criminal cases and are nearly all settled by plea bargain. Second, over half of the criminal cases were violations of 33 U.S.C. 1319 (1) and (2), a knowing or negligent discharge of pollutants into water from a point source. The next most common environmental crime was a violation of 42 U.S.C. 7413 (c) (1), a knowing violation of the Clean Air Act. Other common criminal violations included the illegal disposal of hazardous waste, the illegal use of pesticides, and the discharge of waste on protected lands.

Data on the corporations' numbers of employees and their revenue were obtained from *ReferenceUSA* and *Dunn and Bradstreet*, business databases that contain financial and demographic information for over 14 million companies.<sup>xvi</sup> We first consulted *Dunn and Bradstreet*, and if company data were missing from that source we then consulted *ReferenceUSA* as a backup. As a result, we were able to obtain data on nearly every company prosecuted. Finally, community demographics were obtained from the EPA's *Enforcement and Compliance History Online* database (ECHO), which estimates demographic characteristics for one-mile radii around various EPA-permitted companies. All demographic data in ECHO that are used in this study are based on the U.S. Census Bureau's STF 3A files (see <http://echo.epa.gov/>). While we are interested in race, ethnicity, and poverty, there are a variety of demographic data available in ECHO, including data on education, age, and sex. It would have been ideal to estimate demographic conditions around the hazardous waste sites at the time the company was sentenced, but censuses are carried out every decade, so these data were only collected once every ten years. However, 2009—the year when census data were collected—is relatively close in temporal proximity to the time of sentencing for the cases in our dataset (2005 to 2010). Thus,



if associations between demographics and monetary penalties do exist, the mismatch in temporal order is likely to introduce a small amount of random error that serves to decrease those associations.

### Missing Cases

Not all criminal cases were posted in PACER because the court will sometimes order documents not to be released for public access. Reasons that cases are not released vary, but prohibited documents may contain things such as trade secrets or names of victims who are minors, among numerous other possibilities. Moreover, sometimes the court clerks simply become overburdened and do not scan in the documents. A total of 98 of the 245 cases we obtained from the EPA contained missing documents because information was not available in electronic format. As a result, these cases are excluded from the sample. In addition, 11 corporations are not listed in the *ReferenceUSA* or the *Dunn and Bradstreet* databases and therefore are excluded from the analysis. Finally, 15 crimes occurred at corporate facilities located in areas where nobody was living, and therefore are also excluded from the study. This left a total of 121 cases to analyze, or 49% of the initial sample.

### Dependent Variable

The dependent variable in this analysis represents monetary sanctions assessed by the federal court (in dollars) against corporations that pled guilty to an environmental criminal violation between January 1, 2005, and December 31, 2010. Monetary penalties for these criminal violations ranged from \$500 to \$6,179,634 across the 121 cases in the analysis. We study monetary sanctions because corporations cannot be imprisoned for violations of criminal law and corporate actors rarely serve prison time for environmental crime.<sup>xvii</sup> Therefore, monetary penalties are the primary punitive action taken by the government against a corporation

that violates a criminal law (Stretesky, 2006). We believe that larger financial penalties generally are more indicative of the severity of the crime (Atlas, 2001; Ringquist, 1998; Stretesky, 2006). Thus, we would expect that race and poverty are extralegal factors that should not be related to monetary penalties. If the race, ethnicity, and poverty composition of a community is related to environmental hazards, then potential environmental injustice may be occurring in the prosecution of environmental crimes.

### Independent Variables

The ECHO database provided demographic information for people residing within a one-mile radius of the environmental crime. We chose the one-mile radius in order to remain consistent with previous research examining environmental hazards (e.g., Atlas, 2001; Liu, 2001).<sup>xviii</sup> The first variable of interest that we examine is the proportion of minorities (Hispanic and African American) living within a one-mile radius of where the environmental crime occurred. We examine the total proportion of minorities because environmental justice theories do not distinguish between the discrimination these two groups might face, and both are generally likely to be faced with higher levels of environmental hazards in their communities. Moreover, this variable is consistent with the work of Atlas (2001), who examined civil and administrative penalties. To compute the proportion of minorities in an area we added the number of African Americans and Hispanics living within one mile of the environmental crime together, and then divided by the total number of people residing within one mile.

The second variable of interest that we examine is poverty. Consistent with previous environmental justice research, it is the poor who are more likely to be exposed to environmental hazards. Thus, the proportion of households that have combined annual incomes below the poverty line and are located within one mile of an environmental crime are examined in this

analysis. To compute the variable proportion poverty we divided the number of residents in poverty within one mile of the environmental crime and then divided by the population living within one mile.

### Control Variables

In addition to environmental justice concerns, we control for additional variables that may impact penalty outcomes. Specifically, we control for company characteristics and case characteristics. Company characteristics impact criminal penalties because larger companies can afford to pay higher penalties. Indeed, 18 U.S.C. § 3572 allows prosecutors and judges to levy fines that take into account the defendant's financial situation, its number of employees, independent actions taken by the corporation to assist in cleanup, and the overall cooperation of the corporate defendant regarding the environmental hazard (18 U.S.C. § 3572(a)(1)-(8)).<sup>xix</sup> Moreover, 18 U.S.C. § 3573 even allows for modification or remission of fines assessed against a corporate defendant if the fine becomes too cumbersome to pay. This is demonstrated in *U.S. v. ECO Finishing Company*. In this case the prosecutors openly stated in the plea agreement (subsection "Sentencing Position of the United States," pages 8-10) that the maximum fine they could assess against the defendant was incredibly high in light of the actual crime. Therefore, the fine assessed needed to be crafted in a way that was punitive, but also feasible, so as to not ruin the business.

With this in mind, we control for (1) annual corporate sales, and (2) the number of employees working for corporate defendants. Annual corporate sales (in millions of dollars) were collected from *ReferenceUSA* and *Dunn and Bradstreet* for the company being charged with a criminal violation.<sup>xx</sup> The number of employees was also gathered from *ReferenceUSA* and

*Dunn and Bradstreet*, and represents the total number of employees in the corporation charged with a crime. As company sales and employees increase, we hypothesize that monetary penalties will also increase.

Any analysis of penalty outcomes in law must also attempt to control for case characteristics—often referred to by lawyers as “the facts of a case.” More specifically, we control for (1) offense severity, differentiating between a felony and a misdemeanor prosecution; (2) how many aggravating circumstances exist in each case; and (3) whether the corporate defendant was fined civilly or criminally prior to the prosecution currently being analyzed.

With these case characteristics in mind, we first created a dummy variable to differentiate between felonies (coded as “1”) and misdemeanors (coded as “0”). Every environmental statute that prescribes criminal sanctions distinguishes between felony and misdemeanor crimes. Generally, felony charges are reserved for the most severe violations of criminal law, while misdemeanor charges are for more minor violations. For instance, 18 U.S.C. § 1319(c)(2)(A) is a felony statute and allows for a punishment up to \$500,000 for each violation, while 33 U.S.C. § 1319(c)(1)(A) is a misdemeanor statute and only allows for a punishment up to \$250,000 for each violation. Therefore, we expect that if a case is prosecuted as a felony, this will be directly related to its incurring a higher fine.

Another important case characteristic involves aggravating circumstances. An aggravating factor is “any circumstance attending the commission of a ‘crime’ or ‘tort’ which increases its guilt or enormity or adds to its injurious consequences, but which is above and beyond the essential constituents of the crime or tort itself” (Black, 1991). It is important to keep in mind that federal sentencing guidelines are no longer mandatory but merely advisory, per the Supreme Court in *U.S. v. Booker* (2005). Prior to the *Booker* ruling, courts and prosecutors relied

upon the mandatory sentencing guidelines put forward by the U.S. Federal Probation Office. Though the sentencing guidelines are no longer mandatory, courts and prosecutors still rely upon them to determine the appropriate fines to assess against corporations that commit environmental crimes. The full list is found in statutory provisions U.S.S.G. § 2Q1.1 through § 2Q1.6. The following are some examples of aggravating circumstances: (1) actual release of a regulated substance;<sup>xxi</sup> (2) violation of permit requirements;<sup>xxii</sup> (3) continuous release of a regulated substance;<sup>xxiii</sup> and (4) release of a regulated substance without a permit.<sup>xxiv</sup> Each PACER document listed the aggravating circumstances associated with the case. We count the total number of aggravating circumstances and then use those values as a proxy for case seriousness. The number of aggravating circumstances ranges from 0 to 6 ( $\bar{x}=3$ ). The greater the number of aggravating circumstances,<sup>xxv</sup> the higher the fine should be.

Our final case characteristic is the number of previous corporate violations. Lynch, Stretesky, & Burns (2004) argue that a corporation's criminal history is one possible penalty predictor, such that violations in the past make future violations more likely. As discussed above, environmental crime statutes require that prior history be a factor in determining penalties. As a result, we code for the past violation history of corporate defendants by counting the number of previous administrative, criminal, and civil violations. This information is reported by the EPA in its public database and was reported in PACER. Prior violations ranged between 0 and 9.<sup>xxvi</sup>

### **Analysis and Results**

To carry out our analysis of monetary fines, we examine the relationship between minority composition, poverty, and monetary penalties for the one-mile radii surrounding the locations of the criminal violations. As indicated by our hypotheses, an inverse association between criminal monetary violations and fines indicates that when environmental crimes occur

in minority and poor areas, the courts do not punish those crimes as severely. Such a finding would be indicative of environmental injustice. To estimate the relationships between demographic characteristics and penalty amounts we first examine mean and median relationships between minority, poverty, and penalty amounts. Next, we examine relationships controlling for company and case characteristics through ordinary least squares (OLS) regression analysis. OLS is an appropriate statistical technique that can be used to estimate linear associations between interval/ratio level variables. In the present analysis, monetary penalties, proportion minority, and proportion in poverty represent ratio level variables. Another advantage of OLS is that it allows us to estimate the effects of variables of interest and controls simultaneously to rule out potential alternative explanations for environmental injustice that may also explain variation in penalty outcomes.

[TABLE 1 ABOUT HERE]

To begin, it is worth examining average fines and the average proportion of poor and minority individuals living within one mile of each criminal violation. This information is included in Table 1. Table 1 demonstrates that while the demographic variables (proportion in poverty and proportion minority) are relatively normally distributed across the one-mile-radius areas surrounding environmental violations, the dependent variable (penalty amount) is significantly skewed, as indicated by the large difference between the mean (\$935,559) and median (\$100,000) penalties. This skewedness contributes to the non-normally distributed residuals in the OLS models, which violate a primary statistical assumption. Thus, we transformed the dependent variable (as did Atlas, 2001) to its natural logarithm to improve the normality of the residuals. After the transformation of the penalty variable, the residuals in the regression models were normally distributed and so no further corrections were warranted.

[TABLE 2 ABOUT HERE]

Table 2 displays Pearson's produce-moment correlations for the proportion minority, proportion in poverty, and the natural log of the penalty amount (the full correlation matrix is Appendix A). Both relationships were negative, suggesting that there could be some potential merit to the environmental injustice hypotheses (H1 and H2). However, these relationships are not statistically significant. Specifically, the correlation between proportion minority and penalty amount is  $-0.077$ , which represents a very weak relationship between the two variables. In addition, the correlation between poverty and penalties is  $-0.051$ . Again this relationship is very weak. Therefore, we suggest that in the case of bivariate relationships there is little indication of environmental injustice when it comes to criminal fines.

Before turning to the multivariate findings, it is important to point out that we encountered problems with heteroskedasticity<sup>xxvii</sup> and multicollinearity.<sup>xxviii</sup> This occurred because the proportions of minority and poor residents are highly correlated (see Appendix A). As a result, the demographic variables were analyzed in two separate series of models (Tables 3 and 4). When poverty and minority status variables are entered into different models heteroskedasticity and multicollinearity do not appear to influence standard errors or coefficient estimates.

[TABLE 3 ABOUT HERE]

Our regression results are displayed in Table 3. These results indicate that there is no support for our first hypothesis [H1]. Though the coefficients for the variable measuring the proportion of minority residents is in the predicted direction it is not statistically significant in any model estimated.

While not the focus of our analyses, the results do indicate that corporate revenue, aggravating factors, and felony status are the significant predictors of penalty amounts in criminal prosecutions. In both models 2 and 3, we see that as corporate revenue increases, the overall fine increases as well. This relationship is exactly what we would expect if prosecutors rely upon 18 U.S.C. § 3573 when they are crafting fines in a plea agreement. Further, we also find that corporations prosecuted for a felony rather than a misdemeanor generally receive a larger fine. This relationship is of no surprise because felony statutes—as we discussed above—generally have larger fines associated with them. Finally, we find that as the number of aggravating factors increase, so does the amount of the penalty ( $p < 0.01$ ).

[TABLE 4 ABOUT HERE]

Turning to our second hypothesis [H2], our results do not suggest a statistically significant relationship between populations below the poverty line and fines. As in Table 2, the coefficients are in the predicted direction. This suggests that environmental injustice is not a serious problem in criminal cases. As is the case in Table 3, the results in models 5 and 6 also show that corporate revenue, aggravating factors, and felony status are significant predictors in criminal prosecutions.

### **Discussion and Conclusion**

This study is the first of its kind to analyze environmental justice concerns in the context of criminal penalties and therefore moves beyond the basic descriptive statistics often presented by traditional legal scholars (Brickey, 2001; Cohen, 1991; O’Hear, 2004). This research also contributes to the handful of studies (Atlas, 2001; Ringquist, 1998) on civil outcomes and lends support to the trends observed in those studies—namely, that we are unable to document the existence of systemic environmental injustice, which suggests that prosecutors take the



environmental justice mandate seriously (at least in their plea negotiations regarding penalties). That is, consistent with prior environmental justice research examining civil and administrative fines (Atlas, 2001; Ringquist, 1998), we find no statistically significant relationships between fines, minority status, and poverty. In fact, our results suggest that crime severity is the best predictor of penalties for corporations violating environmental criminal statutes. The argument that the severity of a crime is the best predictor of an outcome is traditional in legal scholarship and is a doctrine consistently taught in law school. Our results are right in line with this traditional way of thinking.

Like Atlas (2001) and Ringquist (1998) we do not find any evidence of systemic environmental injustice. However, based on the wider body of environmental justice scholarship we do not argue that there is an absence of environmental injustice in disadvantaged communities. Indeed, as we have pointed out, there are a significant number of empirical and case studies that suggest the opposite is true (Bullard, 1990). For example, it may be the case that more severe crimes occur in communities that are composed primarily of disadvantaged residents. If this is true, it could impact the analysis by artificially increasing the penalty amounts in poor and minority areas relative to more white and affluent areas that experience fewer environmental crimes. There is empirical support for this supposition. Specifically, Table 1 reports that environmental crimes occur in areas where, on average, 29% of the residents live in poverty. Thus, a greater proportion of residents living near these crimes are poor than in the U.S. as a whole (i.e., 14% of all U.S. residents live in poverty). This suggests that it simply be the case that environmental injustice occurs because criminal corporations target the most disadvantaged neighborhoods. Future research should examine this potential hypothesis.

This study is not without limitations. First, because there are few criminal prosecutions for environmental violations at the federal level, we examine relatively few cases. Moreover, data on corporate crime are often hard to gather, and while we were able to pull many case files, there were also many that were not released to the public. Thus, a number of cases were also absent from our analysis, which limited the generalizability of our findings, though it is unclear how missing data might impact the strength of the associations between race, ethnicity, and penalties. A second limitation is that we do not know anything about the processes that led to the detection of the environmental crimes that occurred, or about whether environmental injustices manifested themselves in that arena. Third, we recognize that some prosecutions were declined by DOJ and left to the states to prosecute if they chose to do so. Not only do we not know the outcomes of those cases and how they compared to federal outcomes, but we also do not know why these cases were declined by the federal authorities.

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**TABLE 1. AVERAGE (MEAN AND MEDIAN) FINES, PROPORTION OF MINORITY RESIDENTS LIVING WITHIN 1 MILE OF VIOLATION, AND PROPORTION OF RESIDENTS LIVING IN POVERTY WITHIN 1 MILE OF VIOLATION, N=121**

	<i>Penalty Amount</i>	<i>Proportion Minority</i>	<i>Proportion in Poverty</i>
Mean	\$935,559	0.23	0.29
Median	\$100,000	0.12	0.30



**TABLE 2. BIVARIATE CORRELATIONS BETWEEN FINES, PROPORTION OF MINORITY RESIDENTS, AND PROPORTION OF RESIDENTS LIVING IN POVERTY, N=121**

	<i>Monetary Penalty</i>	<i>% Minority</i>	<i>% Below the Poverty Line</i>
<i>Monetary Penalty</i>	1.000		
<i>Proportion Minorities</i>	−0.077	1.000	
<i>Proportion in Poverty</i>	−0.051	0.508***	1.000

\*p<0.10; \*\*p<0.05; \*\*\*p<0.01

TABLE 3. ORDINARY LEAST SQUARES REGRESSION PREDICTING THE NATURAL LOG OF CORPORATE FINES, N=121

	Model 1		Model 2			Model 3		
	B	SE	B	SE		B	SE	
<i>Proportion Minority</i>	-0.62	0.74	-0.68	0.72		-0.93	0.57	
<i>Corporate Revenue (in millions)</i>			$1.36 \times 10^{-5}$	$5.12 \times 10^{-6}$	***	$1.07 \times 10^{-5}$	$4.07 \times 10^{-6}$	**
<i>No. Employees (in thousands)</i>			$-2.58 \times 10^{-4}$	$6.65 \times 10^{-4}$		$-2.95 \times 10^{-4}$	$5.26 \times 10^{-4}$	
<i>Aggravating Factors</i>						0.81	0.12	***
<i>Felony (1=yes)</i>						1.10	0.29	***
<i>No. Prior Actions</i>						0.05	0.05	
<b>Constant</b>	11.86	0.28	11.81	0.34		8.70	0.42	
<b>R<sup>2</sup></b>	0.01		0.06			0.44		

\*p<0.10; \*\*p<0.05; \*\*\*p<0.01

TABLE 4. ORDINARY LEAST SQUARES REGRESSION PREDICTING THE NATURAL LOG OF CORPORATE FINES, N=121

	Model 1		Model 2			Model 3		
	B	SE	B	SE		B	SE	
<i>Proportion Below Poverty</i>	-0.75	1.32	-0.75	1.29		-0.58	1.02	
<i>Corporate Revenue (in millions)</i>			$1.34 \times 10^{-5}$	$5.13 \times 10^{-6}$	**	$1.05 \times 10^{-5}$	$4.11 \times 10^{-6}$	**
<i>No. Employees (in thousands)</i>			$-2.24 \times 10^{-4}$	$6.67 \times 10^{-4}$		$-2.92 \times 10^{-4}$	$5.33 \times 10^{-4}$	
<i>Aggravating Factors</i>						0.81	0.12	***
<i>Felony (1=yes)</i>						1.05	0.29	***
<i>No. Prior Actions</i>						0.05	0.05	
<b>Constant</b>	11.85	0.35	11.78	0.34		8.59	0.46	
<b>R<sup>2</sup></b>	0.01		0.06			0.43		

\*p<0.10; \*\*p<0.05; \*\*\*p<0.01

**APPENDIX A. BIVARIATE CORRELATIONS FOR ALL VARIABLES, N=121**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
<b>1. Monetary Penalty</b>	1.00							
<b>2. Proportion Minority</b>	−0.07	1.00						
<b>3. Proportion Below Poverty</b>	−0.05	0.51***	1.00					
<b>4. Corporate Revenue</b>	0.23**	0.03	0.01	1.00				
<b>5. No. Employees</b>	0.01	0.01	0.06	0.18**	1.00			
<b>6. Aggravating Factors</b>	0.56***	0.01	−0.02	0.06	0.09	1.00		
<b>7. Felony</b>	0.38***	0.10	0.00	0.06	−0.11	0.21**	1.00	
<b>8. No. Prior Actions</b>	0.18*	0.00	−0.05	0.17**	−0.00	0.17*	−0.02	1.00

\*p<0.10; \*\*p<0.05; \*\*\*p<0.01

## Endnotes

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<sup>i</sup> This is the definition of environmental justice promoted by the U.S. Environmental Protection Agency (see <http://www.epa.gov/environmentaljustice/>).

<sup>ii</sup> The all-encompassing nature of green criminology has also stunted theoretical development. Lynch and Stretesky (2011, 293) note that “the multifaceted, issue-driven approach to the field” has slowed theory building in green criminology.

<sup>iii</sup> As is the case with index crimes, criminal cases rarely go to trial. Indeed, of the cases we examine, none were settled at trial. Instead these cases were subject to plea bargains that were negotiated between the prosecution and defense. These plea bargains were then subject to the approval of the judge. As a result, we are unable to draw any conclusions about environmental penalties associated with trial outcomes.

<sup>iv</sup> In the United States, the Environmental Protection Agency does not file criminal charges against potential offenders. Instead, criminal prosecutions are handled by the U.S. Department of Justice.

<sup>v</sup> The protest began when the Ward Transformer Company intentionally sprayed 31,000 gallons of polychlorinated biphenyls (PCBs), which are known to cause birth defects, liver disorders, and skin disorders, along approximately 270 miles of state roads in North Carolina (Begley, 1980; Bullard, 1990).

<sup>vi</sup> <http://www.justice.gov/ej/>.

<sup>vii</sup> [http://www.justice.gov/ej/docs/env\\_enforcement-2427806-v2-ej\\_doj\\_annual\\_report\\_fy2013.pdf](http://www.justice.gov/ej/docs/env_enforcement-2427806-v2-ej_doj_annual_report_fy2013.pdf).

<sup>viii</sup> For example, there is a “chicken and egg” critique to levy at studies finding environmental injustice: did the facilities arrive first and the poor and minority communities follow, or was it

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the other way around? Either scenario has direct implications for determining how an environmental injustice is actually manifesting itself. In addition, some scholars argue that this is a false debate and that regardless of why the pattern exists it still represents an injustice, as institutional discrimination (e.g., bank lending practices, structural inequality) likely produced the pattern of where vulnerable populations settle (see Rhodes, 2005).

<sup>ix</sup> This was quite an accusation, and as a result it attracted the attention of the EPA, Congress, and academia. The EPA initiated an internal review of its practices and now publishes annual public reports regarding concerns of environmental justice and enforcement. The DOJ has effectively mimicked the EPA and also reports on civil and criminal actions it takes, and how those actions are in furtherance of environmental justice concerns. Congress even launched an inquiry into the EPA and DOJ regarding civil and criminal law enforcement and case prosecution (Brickey, 1996).

<sup>x</sup> Specifically, Ringquist argued that the political party of the presiding judge would influence the plea agreement. Further, he hypothesized that Fortune 500 corporations would receive less harsh punishments than non-Fortune 500 corporations.

<sup>xi</sup> In fact, Atlas (2001) found there was a positive relationship between minority populations surrounding environmental hazards and fines assessed against corporations for environmental law violations.

<sup>xii</sup> Ideally the date range would be longer. In order to obtain court documents the first author had to create a PACER account (see note xvi) and pay 10 cents per page for every document acquired. Some plea agreements were as long as 90 pages. Because the first author paid the fees out of pocket, financial constraints forced a shorter date range. Even so, our date range is

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consistent with prior research related to this topic (e.g., Atlas [2001] examined cases from 1985-1991, a six-year range).

<sup>xiii</sup> If a corporation was referred to the DOJ by the EPA for prosecution and the DOJ declined prosecution, the EPA still provided case information. That information included the state agencies that prosecuted the corporation using state laws as opposed to federal laws. Of the 245 corporate cases prosecuted between 2005 and 2010, seven were prosecuted at the state level. These seven cases were excluded from this analysis.

<sup>xiv</sup> PACER is the name of the electronic database where all case files that are part of any federal legal action are stored for public access. Access is not free and requires a quarterly fee as well as a charge of 10 cents per page for printing/downloading.

<sup>xv</sup> Sometimes these documents are part of a plea agreement and are not in a separate document.

<sup>xvi</sup> Both the *ReferenceUSA* and *Dunn and Bradstreet* databases are recognized as accurate reporters of corporate finances, and there are no known reasons to believe the data reported are inaccurate, so the databases serve as worthwhile sources of company information.

<sup>xvii</sup> It should be noted that corporate officers and employees can be imprisoned for violation of environmental laws under the responsible corporate officer doctrine (Lazarus, 1995).

<sup>xviii</sup> For a discussion of why concentric ring measurement is better than using zip codes to measure demographics, see Liu (2001).

<sup>xix</sup> Every plea agreement in this study explicitly states that 18 U.S.C. § 3572 is the statute relied upon to determine appropriate penalties.

<sup>xx</sup> Both databases only report gross revenues. Ideally any analysis would involve using both gross and net revenues, but due to the way the databases report we are able to use only gross revenues.

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<sup>xxi</sup> U.S.S.G. § 2Q1.2(a).

<sup>xxii</sup> U.S.S.C. § 2Q1.2(b)(4).

<sup>xxiii</sup> U.S.S.C. § 2Q1.2(b)(1)(A).

<sup>xxiv</sup> *Ibid.*

<sup>xxv</sup> Unfortunately we do not know what specific evidence (e.g., test results, expert witness testimony, etc.) is used in determining how many aggravating factors are met, or in determining if a crime is a misdemeanor or a felony. This is important information to know and worthy of future investigation—our case files simply do not make specific reference to evidence used to facilitate prosecutorial decision-making.

<sup>xxvi</sup> In our dataset 30 corporations had at least 1 prior fine for an environmental violation. Specifically, 17 corporations (the majority) had only 1 violation, and 1 corporation had 9 prior violations of environmental laws. The remaining 91 corporations are first-time offenders.

<sup>xxvii</sup> In this analysis, theoretical reasoning suggests that we pay particular attention to violations of homoscedastic errors. In short, it is possible that Environmental Protection Agency inspectors and Department of Justice prosecutors better monitor larger corporations. This disproportionate monitoring may cause differential error in residuals according to corporate size, and therefore may introduce heteroskedasticity into the model estimates and distort standard errors. An examination of model residuals with respect to company size (employees and annual revenue) suggests that heteroskedasticity is not a problem for these models.

<sup>xxviii</sup> We also assess the likelihood that multicollinearity may impact model coefficients and standard errors. We did not, however, see any evidence that multicollinearity was a problem, as bivariate correlations (Appendix A) do not appear to exceed 0.26, indicating weak bivariate associations. Moreover, average variance inflation factor (VIF) scores did not exceed 1.13 in any



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of the models we estimated. Most of the time these VIF scores were near 1.05. This provides significant evidence that multicollinearity that resulted from a particular combination of variables had little if any impact on model coefficients and standard errors.

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<i>Monetary Penalty</i>	1.000		
<i>Proportion Minorities</i>	−0.077	1.000	
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	B	SE	B	SE		B	SE	
<i>Proportion Minority</i>	-0.62	0.74	-0.68	0.72		-0.93	0.57	
<i>Corporate Revenue (in millions)</i>			$1.36 \times 10^{-5}$	$5.12 \times 10^{-6}$	***	$1.07 \times 10^{-5}$	$4.07 \times 10^{-6}$	**
<i>No. Employees (in thousands)</i>			$-2.58 \times 10^{-4}$	$6.65 \times 10^{-4}$		$-2.95 \times 10^{-4}$	$5.26 \times 10^{-4}$	
<i>Aggravating Factors</i>						0.81	0.12	***
<i>Felony (1=yes)</i>						1.10	0.29	***
<i>No. Prior Actions</i>						0.05	0.05	
<b>Constant</b>	11.86	0.28	11.81	0.34		8.70	0.42	
<b>R<sup>2</sup></b>	0.01		0.06			0.44		

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TABLE 4. ORDINARY LEAST SQUARES REGRESSION PREDICTING THE NATURAL LOG OF CORPORATE FINES, N=121

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<i>Proportion Below Poverty</i>	-0.75	1.32	-0.75	1.29		-0.58	1.02	
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\*p<0.10; \*\*p<0.05; \*\*\*p<0.01

**APPENDIX A. BIVARIATE CORRELATIONS FOR ALL VARIABLES, N=121**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
<b>1. Monetary Penalty</b>	1.00							
<b>2. Proportion Minority</b>	−0.07	1.00						
<b>3. Proportion Below Poverty</b>	−0.05	0.51***	1.00					
<b>4. Corporate Revenue</b>	0.23**	0.03	0.01	1.00				
<b>5. No. Employees</b>	0.01	0.01	0.06	0.18**	1.00			
<b>6. Aggravating Factors</b>	0.56***	0.01	−0.02	0.06	0.09	1.00		
<b>7. Felony</b>	0.38***	0.10	0.00	0.06	−0.11	0.21**	1.00	
<b>8. No. Prior Actions</b>	0.18*	0.00	−0.05	0.17**	−0.00	0.17*	−0.02	1.00

\*p<0.10; \*\*p<0.05; \*\*\*p<0.01

## Endnotes

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<sup>i</sup> This is the definition of environmental justice promoted by the U.S. Environmental Protection Agency (see <http://www.epa.gov/environmentaljustice/>).

<sup>ii</sup> The all-encompassing nature of green criminology has also stunted theoretical development. Lynch and Stretesky (2011, 293) note that “the multifaceted, issue-driven approach to the field” has slowed theory building in green criminology.

<sup>iii</sup> As is the case with index crimes, criminal cases rarely go to trial. Indeed, of the cases we examine, none were settled at trial. Instead these cases were subject to plea bargains that were negotiated between the prosecution and defense. These plea bargains were then subject to the approval of the judge. As a result, we are unable to draw any conclusions about environmental penalties associated with trial outcomes.

<sup>iv</sup> In the United States, the Environmental Protection Agency does not file criminal charges against potential offenders. Instead, criminal prosecutions are handled by the U.S. Department of Justice.

<sup>v</sup> The protest began when the Ward Transformer Company intentionally sprayed 31,000 gallons of polychlorinated biphenyls (PCBs), which are known to cause birth defects, liver disorders, and skin disorders, along approximately 270 miles of state roads in North Carolina (Begley, 1980; Bullard, 1990).

<sup>vi</sup> <http://www.justice.gov/ej/>.

<sup>vii</sup> [http://www.justice.gov/ej/docs/env\\_enforcement-2427806-v2-ej\\_doj\\_annual\\_report\\_fy2013.pdf](http://www.justice.gov/ej/docs/env_enforcement-2427806-v2-ej_doj_annual_report_fy2013.pdf).

<sup>viii</sup> For example, there is a “chicken and egg” critique to levy at studies finding environmental injustice: did the facilities arrive first and the poor and minority communities follow, or was it

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the other way around? Either scenario has direct implications for determining how an environmental injustice is actually manifesting itself. In addition, some scholars argue that this is a false debate and that regardless of why the pattern exists it still represents an injustice, as institutional discrimination (e.g., bank lending practices, structural inequality) likely produced the pattern of where vulnerable populations settle (see Rhodes, 2005).

<sup>ix</sup> This was quite an accusation, and as a result it attracted the attention of the EPA, Congress, and academia. The EPA initiated an internal review of its practices and now publishes annual public reports regarding concerns of environmental justice and enforcement. The DOJ has effectively mimicked the EPA and also reports on civil and criminal actions it takes, and how those actions are in furtherance of environmental justice concerns. Congress even launched an inquiry into the EPA and DOJ regarding civil and criminal law enforcement and case prosecution (Brickey, 1996).

<sup>x</sup> Specifically, Ringquist argued that the political party of the presiding judge would influence the plea agreement. Further, he hypothesized that Fortune 500 corporations would receive less harsh punishments than non-Fortune 500 corporations.

<sup>xi</sup> In fact, Atlas (2001) found there was a positive relationship between minority populations surrounding environmental hazards and fines assessed against corporations for environmental law violations.

<sup>xii</sup> Ideally the date range would be longer. In order to obtain court documents the first author had to create a PACER account (see note xvi) and pay 10 cents per page for every document acquired. Some plea agreements were as long as 90 pages. Because the first author paid the fees out of pocket, financial constraints forced a shorter date range. Even so, our date range is



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consistent with prior research related to this topic (e.g., Atlas [2001] examined cases from 1985-1991, a six-year range).

<sup>xiii</sup> If a corporation was referred to the DOJ by the EPA for prosecution and the DOJ declined prosecution, the EPA still provided case information. That information included the state agencies that prosecuted the corporation using state laws as opposed to federal laws. Of the 245 corporate cases prosecuted between 2005 and 2010, seven were prosecuted at the state level. These seven cases were excluded from this analysis.

<sup>xiv</sup> PACER is the name of the electronic database where all case files that are part of any federal legal action are stored for public access. Access is not free and requires a quarterly fee as well as a charge of 10 cents per page for printing/downloading.

<sup>xv</sup> Sometimes these documents are part of a plea agreement and are not in a separate document.

<sup>xvi</sup> Both the *ReferenceUSA* and *Dunn and Bradstreet* databases are recognized as accurate reporters of corporate finances, and there are no known reasons to believe the data reported are inaccurate, so the databases serve as worthwhile sources of company information.

<sup>xvii</sup> It should be noted that corporate officers and employees can be imprisoned for violation of environmental laws under the responsible corporate officer doctrine (Lazarus, 1995).

<sup>xviii</sup> For a discussion of why concentric ring measurement is better than using zip codes to measure demographics, see Liu (2001).

<sup>xix</sup> Every plea agreement in this study explicitly states that 18 U.S.C. § 3572 is the statute relied upon to determine appropriate penalties.

<sup>xx</sup> Both databases only report gross revenues. Ideally any analysis would involve using both gross and net revenues, but due to the way the databases report we are able to use only gross revenues.

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<sup>xxi</sup> U.S.S.G. § 2Q1.2(a).

<sup>xxii</sup> U.S.S.C. § 2Q1.2(b)(4).

<sup>xxiii</sup> U.S.S.C. § 2Q1.2(b)(1)(A).

<sup>xxiv</sup> *Ibid.*

<sup>xxv</sup> Unfortunately we do not know what specific evidence (e.g., test results, expert witness testimony, etc.) is used in determining how many aggravating factors are met, or in determining if a crime is a misdemeanor or a felony. This is important information to know and worthy of future investigation—our case files simply do not make specific reference to evidence used to facilitate prosecutorial decision-making.

<sup>xxvi</sup> In our dataset 30 corporations had at least 1 prior fine for an environmental violation. Specifically, 17 corporations (the majority) had only 1 violation, and 1 corporation had 9 prior violations of environmental laws. The remaining 91 corporations are first-time offenders.

<sup>xxvii</sup> In this analysis, theoretical reasoning suggests that we pay particular attention to violations of homoscedastic errors. In short, it is possible that Environmental Protection Agency inspectors and Department of Justice prosecutors better monitor larger corporations. This disproportionate monitoring may cause differential error in residuals according to corporate size, and therefore may introduce heteroskedasticity into the model estimates and distort standard errors. An examination of model residuals with respect to company size (employees and annual revenue) suggests that heteroskedasticity is not a problem for these models.

<sup>xxviii</sup> We also assess the likelihood that multicollinearity may impact model coefficients and standard errors. We did not, however, see any evidence that multicollinearity was a problem, as bivariate correlations (Appendix A) do not appear to exceed 0.26, indicating weak bivariate associations. Moreover, average variance inflation factor (VIF) scores did not exceed 1.13 in any

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of the models we estimated. Most of the time these VIF scores were near 1.05. This provides significant evidence that multicollinearity that resulted from a particular combination of variables had little if any impact on model coefficients and standard errors.